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the earth's crust nearly as large as that of Europe. Volcanic dust fell on an island ninety-five miles to the windward in such quantities that trees were crushed to the earth by the weight of its mass. During the eruption subterranean noises were heard at Caracas, and in the midst of the Llanos, which cover a space of 36,000 square miles. (Proc. Phila. Acad. Nat. Science, 1890.)

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## MINERALOGY AND PETROGRAPHY.<sup>1</sup>

**Petrographical News.**—The protogine of Mont Blanc is shown by Lévy<sup>2</sup> to be a true eruptive, apophyses from which penetrate the surrounding schists and alter them, and break from them fragments which they hold as inclusions. These fragments have been regarded as basic segregations, and the surrounding schists have been looked upon as dynamo-metamorphosed phases of the protogine. Both of these views the author combats. Among the schists he finds eclogites, with diopside in micropegmatitic intergrowths with quartz and feldspar, amphibolites and mica-schists, each of which classes is briefly described. The segregations mentioned occur most frequently near the contact of the granite with the schists. Many of them resemble so closely certain phases of the schists that Lévy is compelled to regard them as fragments of these caught up by the eruptive during its passage from below. A microgranite from the periphery of the main mass of granite consists of corroded crystals of the first generation cemented by a granitic ground-mass. This fact is thought to be an indication of the correctness of the view that the constituents of granite are mainly of the second generation, those of the first consolidation having disappeared. To the southeast of Mont Blanc are quartz-porphyrries which, according to Graeff,<sup>3</sup> are genetically related to the granite composing the body of the mountain. Like the latter, the porphyries have been subjected to pressure, by which process much sericite has been developed, resulting in sericite-schists. The present contact of the eruptives with the gneisses and mica-schists of the Mont Blanc "massif" is thought not to be an original contact, but one brought about by dislocations. The conclusions of Lévy and Graeff are thus seen to be in accord in some particulars, while in others they are at variance. Fuller discussions are promised later.—In the first part of a general

<sup>1</sup> Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

<sup>2</sup> Bull. des Serv. d. l. Carte. g  ol. d. la France, No. 9, 1890.

<sup>3</sup> Archiv. des Sciences phys. et nat., Nov., 1890.  
Am. Nat.—April.—5.

sketch of the geology of the Japanese Islands Harada<sup>4</sup> gives short descriptions of Archean gneisses and schists, and of eruptive rocks of more recent age. Among the schists are mentioned graphitic sericite-schists, with well-developed crystals of tourmaline and hematite, and a chloritic amphibolite whose principal feldspar is albite. Gabbros and peridotites cut the Paleozoic strata. In some specimens of the former piedmontite was noticed as an alteration product of hornblende. In the Mesozoic occurs the largest quantity of eruptives. Granite and diorite in many varieties cut through the sedimentary rocks, and change them near the contact into hornstones holding cordierite and ottrelite. In sericite-gneiss garnets are produced, in amphibolites andalusite is a new product, and in limestone wollastonite and garnet result from the contact action. The eruptives, on the other hand, become coarse-grained and porphyritic near the contact, the diorite losing hornblende and gaining quartz and orthoclase, until it finally resembles a granite. Among the effusives of this age are mentioned quartz-porphyrries and porphyrites.—Weinschenck<sup>5</sup> communicates additional information with respect to the rocks of these islands, as a result of the study of some hand specimens. Most of the sections examined by him are of a hypersthene andesite, with a plagioclase full of inclusions, and a pleochroic monoclinic pyroxene which sometimes forms intergrowths with hypersthene. Among the rocks from the extinct volcanoes is a bronzite trachyte containing biotite, garnet, and tridymite in a ground-mass of the same minerals and zircon, in a trichitic glass. The most interesting rock of the series bears the same relation to the andesites as the augitites do to the basalts. It consists principally of acicular crystals of bronzite in a ground-mass consisting of clear glass and magnetite grains, with porphyritic plagioclase and garnets. The author calls the rock *sanukite*, from the province in which it is found.

**Mineralogical News.**—The regular silicates are very few in number, and of them eight are orthosilicates,—viz., *eulytite*, *zunyite*, *helvite*, *danalite*, *garnet*, *sodalite*, *nosean* and *hawyne*, and *lasurite*. These Brögger and Backström<sup>6</sup> would include in one group, which they would call the garnet group. The members of this group is divided into two sub-groups, in one of which the tetrahedral habit is predominant and the cleavage is octahedral. This includes the first four minerals mentioned above, and is known as the *helvite* group. All its members can be represented by formulas of the garnet type. *Helvite* may be

<sup>4</sup> Die Japanischen Inseln., 1st Lief., Berlin, Parey, 1890.

<sup>5</sup> *Neues Jahrb. f. Min.*, etc., B. B. VII., p. 133.

<sup>6</sup> *Zeits. f. Kryst.*, XVIII., 1890, p. 209.

written  $(\text{MnFeCa})_2(\text{Mn}_2\text{S})\text{Be}_3(\text{SiO}_4)_3$ , danalite as  $(\text{FeZnMn})_2[(\text{ZnFe})_2\text{S}]\text{Be}_3(\text{SiO}_4)_3$ , zunyite as  $[(\text{OH})_9\text{Fe}_2\text{ClAl}_6](\text{SiO}_4)_3$ , and eulytite as  $\text{Bi}_4(\text{SiO}_4)_3$ . The second sub-group includes the species with with dodecahedral habit and cleavage. Embraced in this is the garnet series proper, with a composition  $\text{R}_3^{\text{II}}\text{R}_2^{\text{III}}(\text{SiO}_4)_3$ , and the series of the alkaline garnets. The etched figures on the latter indicate that they are all tetrahedrally hemihedral, and a discussion of the best analysis of them leads to the conclusion that they are all of the chemical type of common garnet. Sodalite is  $\text{Na}_4(\text{AlCl})\text{Al}_2(\text{SiO}_4)_3$  and nosean is  $\text{Na}_4[\text{Al}(\text{NaSO}_4)]\text{Al}_2(\text{SiO}_4)_3$ . In hauyne, calcium replaces some of the sodium in nosean. Lapis-lazuli, or natural ultramarine, is a mixture of several minerals, of which one is bright blue. The authors have isolated this and found it to contain :

$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	$\text{CaO}$	$\text{Na}_2\text{O}$	$\text{K}_2\text{O}$	$\text{SO}_3$	$\text{S}$	$\text{Cl}$
32.52	27.61	6.47	19.45	.28	10.46	2.71	.47

Upon the assumption that this is a mixture of hauyne, sodalite, and ultramarine, it is calculated that the latter substance must be represented by the formula  $\text{Na}_4[\text{Al}(\text{S}_3\text{Na})]\text{Al}_2(\text{SiO}_4)_3$ . The authors then discuss the nature of artificial ultramarine, and conclude that it is a mixture of five isomorphous substances. A microscopical examination of lapis-lazuli reveals the fact that in all cases this is a mixture of several substances, among which may be mentioned hauyne, diopside, kokscharowite, calcite, pyrite, and a muscovite-like mineral, together with a little scapolite, plagioclase, orthoclase, apatite, sphene, zircon, and an unknown, probably positive, uniaxial mineral.—The interesting Chilean minerals continue to be subjects of investigation to those who are fortunate enough to come into possession of them. Frenzel<sup>7</sup> describes briefly a few of the rarer among them. *Sideronatrite*, with a yellow color and a metallic lustre, has a density of 2.31, and a composition as follows :

$\text{SO}_3$	$\text{Fe}_2\text{O}_3$	$\text{Na}_2\text{O}$	$\text{H}_2\text{O}$	
42.93	22.86	17.49	15.66	$= 2\text{Na}_2\text{SO}_4 + \text{Fe}_2\text{S}_2\text{O}_9 + 6\text{H}_2\text{O}$

The mineral is from Sierra Gorda, near Caracoles. It is identical with the Peruvian sideronatrite described by Raimond,<sup>8</sup> which, however, was regarded by him as possessing but one molecule of  $\text{Na}_2\text{SO}_4$  to one of the iron sulphate. It is probably an alteration product of *hohmannite*, occurring associated with it, and found also in the Sierra de la Caparrosa, as brownish-red, glassy plates and crystals, often arranged in radial aggregates. Their hardness is 3, and specific gravity 2.17.

<sup>7</sup> *Miner. u. Petrog. Mitth.*, XI., 1890, p. 214.

<sup>8</sup> *Zeits. f. Kryst.*, 1882, VI., p. 627.

They remain unchanged in the air, and have the same composition as amarantite and the specimens of hohmantite<sup>9</sup> analyzed a short time since,—viz.,  $\text{Fe}_2\text{S}_2\text{O}_9 + 7\text{H}_2\text{O}$ . Various other minerals from the same region are briefly alluded to in this paper, and two new ones (quetenite and gordaite)<sup>10</sup> are described. Messrs. Genth and Penfield<sup>11</sup> have examined some of these species in more detail. The material in their possession is from the Mina de la Campania, near Sierra Gordo. *Amarantite* is found to be triclinic with  $a:b:c = .76915:1:.57383$   $\alpha = 95^\circ 38' 16''$ ,  $\beta = 90^\circ 23' 42''$ ,  $\gamma = 97^\circ 13' 4''$ . The habit of the crystals is prismatic. The brachy, and macropinacoids are vertically striated, and a perfect cleavage is parallel to each. The optical angle  $2E^{\text{na}} = 63^\circ 3'$ , and the extinction in the macropinacoid is  $16^\circ - 17^\circ$ , in acute  $\beta$ . Fibres of *sideronatrite* show a slight pleochroism, with a pale straw-yellow color parallel to the longer axis, and no color at right angles to this. The formula ascribed to the substance differs from Frenzel's formula in lacking one molecule of water. *Ferronatrite*, although obtainable only in white or grayish cleavage masses, is thought to be hexagonal. Its indices of refraction are  $\omega = 1.558$ ,  $\epsilon = 1.613$ , and its composition is  $\text{SO}_3 = 51.30$ ;  $\text{Fe}_2\text{O}_3 = 17.30$ ;  $\text{Na}_2\text{O} = 19.95$ ;  $\text{H}_2\text{O} = 11.89$ ; specific gravity =  $2.547 - 2.578$ . Darapsky<sup>12</sup> also gives a few notes of observations on a few of the minerals from Atacama. Among these are *aromite*, *paposite*, *amarantite*, *hohmannite*, *coquimbite*, *fibroferrite*, *nebrite*, *botryogen*, *thenardite*, *quartz*, and *halite*.—Bauer<sup>13</sup> describes the first interpenetration twin of *tourmaline*, from an unknown locality. The twinning plane is R, and the forms observed in the individuals are  $\infty P_2$  and  $-2R$ . A pseudomorph of *aragonite* after calcite, from Müsen in Siegen, is one of the few instances described in which the latter mineral is known to have changed into the former one. They consist of shells of calcite enclosing a white granular calcite holding crystals of barite and snow-white aragonite. These fill two-thirds of the space within the shell, the remaining one-third being hollow. The pseudomorph is supposed to be due not to the molecular replacement of the calcite, but to solution of the interior of the crystal and subsequent deposition of calcium carbonate from calcium-bearing solutions containing traces of barium. By experimentation Bauer has found that barium bearing calcium carbonate solu-

<sup>9</sup> *Miner. u. Petrog. Mitth.*, IX., p. 397.

<sup>10</sup> *AMERICAN NATURALIST*, Dec., p. 1190.

<sup>11</sup> *Amer. Jour. Sci.*, Sep., 1890, p. 199.

<sup>12</sup> *Neues Jahrb. f. Min.*, etc., 1890, I., p. 49.

<sup>13</sup> *Neues Jahrb. f. Min.*, etc., 1890, I., p. 10.

tions deposit crystals with the properties of aragonite. The crystals of *lievrite*, from Dillenburg, Nassau, fall into two classes. The first includes well-developed prismatic forms with large macrodomes ( $\bar{P}\infty$ ) on both terminations. The others are prismatic with  $\bar{P}40$  and  $\bar{P}2\frac{3}{5}$  on one termination. The other is attached to the gangue. Their axial ratio is .6795 : 1 : .4576. In the article by Messrs. Genth and Penfield <sup>14</sup> referred to above appear analyses of *picropharmacolite* from Joplin, Mo., of a substance supposed to be ——— from near Georgetown, N. M.; of *pitticite* from the Clarissa Mine, in the Tintic District, Utah; and of *gibbsite* from White Horn Station, Chester Co., Pa. The last-named mineral is discovered to be a hydrous aluminium phosphate. The *pitticite* corresponds in composition to  $4\text{Fe}_2\text{As}_2\text{O}_8 \cdot \text{Fe}_2(\text{OH})_6 + 20\text{H}_2\text{O}$ .—The remarkable mineral locality, Branchville, has again been reported upon by Messrs. Brush and Dana.<sup>15</sup> During the ten years that have elapsed since their previous report <sup>16</sup> extensive mining has been carried on at the locality for the purpose of obtaining quartz and microcline for technical uses. During the past two years large quantities of rare magnesian phosphates have been brought to light, and these have been investigated by the mineralogists mentioned. The minerals whose identification is recorded are *lithiophilite*, *hureaulite*, *reddingite*, *fairfieldite*, *dickinsonite*, and *fillowite*. The *lithiophilite* is in rudely crystalline masses in a vein, associated with albite, quartz, and spodumene. It is, as a rule, fresh. Occasionally it is extensively altered into *hureaulite* through the intermediate product *dickinsonite*. The succession in age of its various decomposition products, among which are all the other minerals mentioned above, could not be determined, as they seem to occur together promiscuously. The *hureaulite*, heretofore known only at Limoges, France, is in small monoclinic crystals, varying in color from violet to orange red, and united into parallel aggregates. Their axial ratio is  $a : b : c = 1.9192 : 1 : .5245$  with  $\beta = 84^\circ 1'$ , on the assumption of the plane  $\frac{4}{3}P\frac{4}{3}$ , determined by Descloizeaux in the Limoges crystals as the ground form. The habit of the Branchville crystals is short prismatic, with  $\infty\bar{P}\infty$  and various pyramids well developed. The crystals have a good cleavage parallel to the orthopinacoid, a specific gravity of 3.149, and a composition as follows:

$\text{P}_2\text{O}_5$	FeO	MnO	CaO	$\text{H}_2\text{O}$	Quartz.
38.36	4.56	42.29	.94	12.20	1.76

<sup>14</sup> *Amer. Jour. Sci.*, Sep., 1890, p. 199.

<sup>15</sup> *Amer. Jour. Sci.*, Mch., 1890, p. 201.

<sup>16</sup> *Ib.*, 1880, p. 257.

corresponding to  $\text{H}_2(\text{MnFeCa})_5\text{PO}_4 + 4\text{H}_2\text{O}$ . Reddingite is in pinkish-white masses, and in orthorhombic crystals with an octahedral habit. The axial ratio is  $a:b:c = .8678:1:.9485$ , and density 3.204. Their analysis yielded Mr. Wells:

$\text{P}_2\text{O}_5$	FeO	MnO	CaO	$\text{H}_2\text{O}$	Quartz.
34.90	17.13	34.51	.63	13.18	.13

a result expressed by the formula  $(\text{FeMn})_3(\text{PO}_4)_2 + 3\text{H}_2\text{O}$ . Fairfieldite is in transparent foliated masses of a whitish or greenish-white color and a brilliant lustre, inclining to pearly on the perfect cleavage. Its composition agrees with the symbol  $\text{Ca}_2\text{Mn}(\text{PO}_4)_2 + 2\text{H}_2\text{O}$ . Dickinsonite is a bright green chlorite-like mineral with a micaceous structure and rhombic tabular habit.—The beautiful *chalcopyrite*<sup>17</sup> crystals from the French Creek Mines, Chester Co., Pa., occur together with pyrite<sup>18</sup> imbedded in byssolite, thuringite, and calcite in pockets in a magnetic iron ore. The principal type of the chalcopyrite is the sphenoid  $\frac{3}{2}\text{P}$  often modified by a scalenohedron. All the faces are striated, and frequently they are so much rounded as to preclude measurements of their interfacial angles. Twinned crystals are quite common, the combination possessing an hexagonal habit.—The rare zeolite *mordenite* has been discovered by Pirsson<sup>19</sup> in the cavity of an amygdaloidal basalt, forming fragments in a breccia near Hoodoo Mt. in Western Wyoming. The mineral is in very small crystals, with a specific gravity lying between 2.119 and 2.179. Their analysis yields:

$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	FeO <sub>3</sub>	CaO	MgO	$\text{K}_2\text{O}$	$\text{Na}_2\text{O}$	$\text{H}_2\text{O}$
66.40	11.17	.57	1.94	.17	3.58	2.27	13.31

which is equivalent to  $3\text{RAl}_2\text{Si}_{10}\text{O}_{24} + 20\text{H}_2\text{O}$ , in which R represents potassium, sodium, and calcium. The mineral differs from ptilolite in containing more water. In crystallization it is monoclinic, and is isomorphous with heulandite. Its habit resembles that of beaumontite.  $a:b:c = .4010:1:.4262$ ,  $\beta = 88^\circ 30.5'$ . The plane of the optical axes is perpendicular to  $\infty\text{P}\infty$ , and the extinction on this face is  $15^\circ$  to the clino-axis.—A careful examination of the *apophyllite* of the Seiser Alps indicates to Ploner<sup>20</sup> that the differences in the lengths of the crystallographic axes of specimens of the minerals from different localities, and occasionally even in different parts of the same individual, are due to variations in the positions of planes to which identical symbols have been given. The new forms detected on the crystals

<sup>17</sup> Penfield. *Amer. Jour. Sci.*, Sep., 1890, p. 207.

<sup>18</sup> Penfield. *Ib.*, III., XXXVII., p. 209.

<sup>19</sup> *Ib.*, Sep., 1890, p. 232.

<sup>20</sup> *Zeits. f. Kryst.* XVIII., 1890, p. 337.

examined are  $\frac{1}{10}P$ ,  $\frac{1}{5}P$ ,  $\frac{2}{7}P$ ,  $\infty P$ ,  $P\infty$ ,  $\frac{5}{8}P\infty$ ,  $\frac{1}{2}P\frac{3}{2}$ ,  $3P\frac{3}{2}$ ,  $\infty P_2$ , and  $\infty P_3$ , making ninety-seven forms now known to occur in the species.—Baumhauer<sup>21</sup> has discovered some small but good crystals of *cryolite* in a hand specimen from Evigtok, Greenland, so twinned that both individuals have their basal planes in common, and one appears to have been revolved about  $88^\circ 2'$  around an axis normal to the base.—The limestone of Villefranche and of Biarritz, France, contains long needles of quartz and crystals of dipyr and albite,<sup>22</sup> the first of which must have been formed contemporaneously with the limestone, while the last two were produced by the influence of an intrusive mass of diabase upon the enclosing rock.—Traube<sup>23</sup> ascribes the differences in the values of the axial ratios of different *scheelites* to the amounts of molybdenum occurring in them. Analyses of many specimens reveal the fact that white and light yellow varieties contain but little of this element, while the dark varieties contain quite large amounts, (1–8%). The axial ratio of the purest scheelite is 1 : 1.5315, that of calcium molybdenate is 1 : 1.5458, and that of most scheelites between these limits.—In the pegmatite veins cutting granite near Meissen, Saxony, Sauer and Ussing<sup>24</sup> have found Baveno twins of *microcline* in which the gridiron structure is lacking. Lamellæ of albite are intergrown with the microcline, but sufficiently large areas of the latter mineral were found to allow of careful measurements of cleavage, angles, etc. The angle between the cleavage lines is  $89^\circ 30'$ , and the refractive indices for sodium light  $\alpha = 1.5224$ ,  $\beta = 1.5264$ ,  $\gamma = 1.5295$ . The optical angle is  $2V = 83^\circ 41'$ .—A pure white *zinc sulphide* is mentioned by Mr. Robertson<sup>25</sup> as occurring at Galena, Cherokee Co., Kansas. It is associated with sphalerite, and is in a form suggesting the moist, freshly prepared substance. It is saturated with water bearing a trace of sulphuric acid. Its composition is: Zn = 63.70; S = 30.77; Fe<sub>2</sub>O<sub>3</sub> = 2.40; Insol. = 2.52.—Rinne<sup>26</sup> gives some good illustrations of *microcline* structure in the feldspar of the Stockholm granite and of the Kyffhäuser gneiss, and suggests reasons for regarding it as a secondary phenomenon produced in non-striated feldspar.—The *phenacite* reported by Mr. Yeates<sup>27</sup> from

<sup>21</sup> Ib., XVIII., 1890, p. 355.

<sup>22</sup> Beaugéy. Bull. Soc. Franc. d. Min., XIII., Feb., 1890, p. 59.

<sup>23</sup> Neues Jahrb. f. Min., etc., B. B. VII., p. 232.

<sup>24</sup> Zeits. f. Kryst., XVIII., 1890, p. 192.

<sup>25</sup> Amer. Jour. Sci., Aug., 1890, p. 161.

<sup>26</sup> Neues. Jahrb. f. Min., etc., 1890, II., p. 66.

<sup>27</sup> Amer. Jour. Sci., Sep., 1890, p. 259.



Hebron, Me., turns out upon analysis to be apatite with a tabular habit.

**New Minerals.**—A new borate has been discovered imbedded in the form of small, colorless, transparent, or milky-white crystals in the pinnolite of Stassfurt, Germany. The crystals are monoclinic, with two perfect cleavages perpendicular to the plane of symmetry. One of these is assumed as the base, and the other as the orthopinacoid, when the axial ratio becomes  $a:b:c = 2.1937:1:1.73385$ ;  $\beta = 80^\circ 12'$ . The forms observed are  $\infty P_\infty$ ,  $\infty P$ ,  $-P$ ,  $\frac{1}{2}P$ ,  $P_\infty$ , and  $-3P_3$ . Hardness is 4–5; density, 2.127. The plane of the optical axes is perpendicular to the plane of symmetry, and makes with  $c$  an angle of  $7^\circ$  in acute  $\beta$ .  $A=b$ .  $2H_{na} = 104^\circ 27'$ . The composition of the substance, as found by Baurath, is:

$B_2O_3$	MgO	$K_2O$	$Na_2O$	Cl	$H_2O$
52.13	13.80	8.14	.39	.35	23.83

which corresponds to  $H_4Mg_2K(BO_2)_9 + 6H_2O$ . The name Hintzeite has been given it by Milch.<sup>28</sup> The same mineral is described under the name Heintzite by Leudecke.<sup>30</sup> According to this investigator, the mineral is easily soluble in hydrochloric and nitric acids. An analysis yielded results different from those above given, as follows:  $B_2O_3 = 60.53$ ;  $MgO = 12.23$ ;  $K_2O = 7.39$ ;  $H_2O = 19.85$ . The axes chosen by Leudecke have the ratios  $a:b:c = 1.2912:1:1.7572$ ;  $\beta = 57^\circ 41' 4$ . The principal cleavages are thus parallel to  $oP$  and to  $\frac{1}{2}P_\infty$ . The refractive index for sodium light vibrating parallel to  $A$  is 1.354. The other optical properties coincide with those determined by Milch. Prof. Groth suggests that neither of the two names suggested for the mineral be accepted until it is found which analysis is correct.—**Powellite.**—In a weathered fragment of bornite from the Devil's Mining Region, in Idaho, Mr. Melville<sup>30</sup> has discovered a mineral resembling scheelite in external appearance, but differing from it in composition. The crystals are small, prismatic, greenish-yellow in color, with a hardness of 3.5, and a density of 4.526. They have a resinous lustre, and are semi-transparent and brittle. Measurements of angles indicate a tetragonal symmetry with  $a:c = 1:1.5445$ . The planes appearing  $oP$ ,  $P$ ,  $P_\infty$ , and  $\infty P$ . The composition is:

$MoO_3$	$WO_3$	$SiO_2$	CuO	MgO	$Fe_2O_3$	$Al_2O_3$	CuO	S
58.58	10.28	3.25	25.55	.16	1.65	tr.	tr.	und.

<sup>28</sup> *Zeits. f. Kryst.*, XVIII., 1890, p. 479.

<sup>29</sup> *Ib.*, p. 481.

<sup>30</sup> *Amer. Jour. Sci.*, Feb., 1891, p. 141.

The mineral bears the same relation to calcium molybdate as scheelite does to the corresponding tungstate.—An isotropic or weakly doubly refracting mineral occurs in the nepheline-syenite of a “massif” in the Kola Peninsula, Russia. Since its properties have not yet been fully determined, its discoverer, Ramsay,<sup>31</sup> has not yet assigned to it a name. The mineral is red and transparent. It fuses easily, and yields water. It is attacked by acids with difficulty, has a low index of refraction,  $n_{na} = 1.5223$ , and possesses no cleavage. Its density is 2.753, and composition:

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub> Fe <sub>2</sub> O <sub>3</sub>	MnO	CuO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	Loss
55.88	15.19	2.67	9.53	.53	9.06	1.57	6.04

—*Leverrierite*<sup>32</sup> occurs in small pseudohexagonal prisms that are twinned orthorhombic forms with a prismatic angle of  $128^\circ$ . They have a very perfect cleavage parallel to oP, so that they may easily be mistaken for mica. Often the prisms are twisted so that they resemble worm tubes to such perfection that they have been mistaken for organic markings, and have been described under the name *bacillarites*. According to Termier, all specimens of bacillarites examined by him are prisms of the new mineral whose composition is  $H_{10}Al_4Si_5O_{21}$ . The hardness of the substance is 1.5, and its density 2.3–2.4. The plane of its optical axes is  $\infty\bar{P}\infty$ , with a negative acute bisectrix normal to oP and an optical angle  $2V = 45^\circ - 52^\circ$ . It may be distinguished from muscovite by its dark color, and from biotite by its weak pleochroism, and its weak double refraction. Leverrierite is found as a metamorphic constituent in carbonaceous clay slates, and in interstratified carboniferous eruptives.

<sup>31</sup> Ref. *Neues Jahrb. f. Min.*, etc., 1891, I., p. 98.

<sup>32</sup> Bull. Soc. Franc. d. Min., XIII., 1890, p. 325.